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# BOOTSTRAP ESTIMATE OF TIME TO PREGNANCY (TTP) AMONG NEPALI WOMEN'S OF ASSAM

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## ABSTRACT

On the basis of epidemiologic ideas there are several options for the study of human fertility. One is the study of male semen characteristics. Menstrual cycle and clinical diagnosis of infertility among the fertile women are another two options to study fertility. The fourth option is the study of fecundability based on the waiting time to pregnancy. In this paper fecundability in terms of mean time to pregnancy has been estimated. It concentrates on the basic ideas of quantitative measure of fertility and application of bootstrap method to find the mean time to pregnancy (TTP). The bootstrap is the simplest re-sampling procedure to use, in modern statistics, when sufficient data cannot be collected. This paper has been started with the literature survey of fecundability and concludes with an exposition of the bootstrap estimate of standard error for TTP.

**KEYWORDS:** Fecundability, Time to Pregnancy (TTP), Bootstrap

## INTRODUCTION

Biologically of all the function of the human body, reproduction was among the last to be understood. The idea of men's sperm and women's egg can join to make a new person is, today becomes so common place that we can easily forget how radical it once seemed [Wilcox 2010]. Statistically the mechanism of making men biologically is termed as fertility. Technically the word fertility is used in relation to the actual production of children (i.e. live birth). Whereas fecundity stands for the capacity to produce a baby by an women.

Fecundability is a quantitative measure of a couple's capacity to conceive, defined as the couple's probability of conceiving in one menstrual cycle (assuming the couples are having regular unprotected intercourse). Actually we cannot know a given couple's fecundability, but we can calculate the mean fecundability in the form of mean TTP for a group of couples. It determines the expected length of time from starting unprotected intercourse till conception (time to pregnancy; TTP) and to properly estimate fecundity complete follow-up after a well defined starting time is needed [Olsen et.al 1999].

The bootstrap method was first proposed by Bradly Efron [Efron 1979] and further together with R. J Tibshirani [Efron and Tibshirani 1993], as a non parametric re-sampling statistical method for estimating the sampling distribution of an estimator by sampling with replacement from the original sample. The bootstrap is conceptually the simplest of all re-sampling techniques. It is by now a standard method in modern Statistics. The idea of bootstrap is to develop a set up generate more artificial (Pseudo) data using the information of the original data. True underlying sample properties are reproduced as closely as possible and unknown model characteristics are replaced by sample estimates.

The usefulness of bootstrap technique, ideas of quantitative measure of fertility, mean time to pregnancy (TTP) and bootstrap estimate of standard error for TTP have been discussed in this paper citing primary data base illustration.

## DATA AND METHOD

The study sample consisted of the pregnant women who conceived for the first time and respond to share the menstrual cycle required to conceive. Thus the data considered here are primary in nature. In this study we consider the Nepali speaking couples from Sonitpur district of Assam who are ready to experience their parenthood randomly to know the time to pregnancy (TTP). Unfortunately only 10 couples had respond on the query and so we consider the bootstrap method to generate more artificial (Pseudo) data to find the mean estimate of TTP.

## FECUNDITY AS THE PROBABILITY OF PREGNANCY

Fecundability is a quantitative measure of a couple's capacity to conceive, defined as the couple's probability of conceiving in one menstrual cycle (assuming the couples are having regular unprotected intercourse). A couple's chances of conceiving with unprotected intercourse on the most fertile days (Usually 7-21$^{st}$ days of the menstrual cycle are considered as the most fertile days called fertile window on the assumption that ovulation of a normal women occurred in middle of the cycle.) of a menstrual cycle can vary from zero to 100%. Thus fertility in its essence is a matter of probability. This under laying probability is expressed in the time (number of cycles) a couple requires conceiving. According to A. J. Wilcox and his colleagues [Wilcox et.al 2000], couples with high probability of conception are likely to conceive within one or two cycles. On the other hand couples with low probability of conceiving may take many cycles of trying. These couples are clinically diagnosed as sub-fertile or infertile. Couples with a zero chance of conceiving will not conceive naturally no matter how many cycles they try. These couples are known as sterile. There are many factors which affect the probability of pregnancy. Age, medical conditions (fertile/sterile/health), life style, menstrual cycle, ovulation etc all affect likelihood of conceiving in each cycle. The most important factor of affecting chances of conceiving is the timing and frequency of intercourse in fertile window. The probability of conception in due intercourse on a specific day of fertile window in relation to day of ovulation is considered in the following figure 1. The probabilities presented here are taken from [Wilcox et.al 1998].

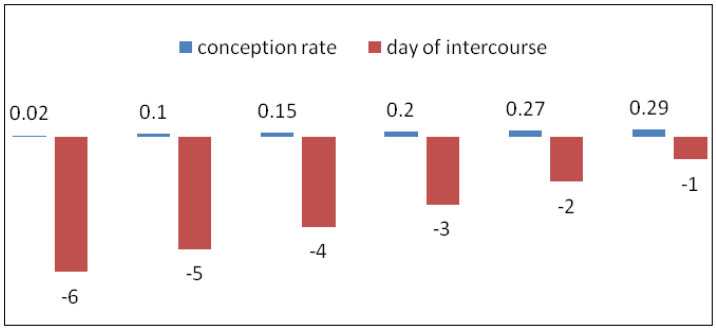


**Figure 1: Probability of Conception after the Day of Ovulation**

Here we consider the day -1, -2 and so on to represent the day after ovulation that is -1 represents one day after the ovulation. It has been already mentioned that individual probability of a couple to conceive cannot be calculated instead we find the mean chances of conceiving of a group of couples. The actual ovulation of women cannot be predicted exactly, it is assumed that ovulation started in the middle of a menstrual cycle.

## BOOTSTRAP ESTIMATE OF TTP

One of the nice things about bootstrapping is that it can be done in EXCEL. MS-EXCEL 2007 (with ANALYSIS TOOLPAK in MS-Office 2003) has a random number generator in the statement =RANDBETWEEN (N1, N2), where N1 and N2 represent the range of the random numbers to be generated. The next set of numbers is the random samples, with replacement from the original data set, which we get by the statement $= HLOOKUP\left(C3, \$C\$1:\$L\$2, 2, FALSE\right)$ technically we called bootstrap samples. Where C3, denotes a random number entry, for which we need to find the corresponding entry in the original data row, in the array $\$C\$1:\$L\$2$, the first row is the index value corresponding to a data entry in the next row and final entry $FALSE$ insures that the function returns the exact required value. According to B. Efron and R. J. Tibshirani [Efron and Tibshirani 1993] one can have a reliable estimate considering the bootstrap replications (B) at least $B = 50$. Thus in the present study there are 50 bootstrap samples has been consider to find the estimate of TTP. The five out of fifty sets of bootstrap samples of **n=10** items are presented in figure 2.

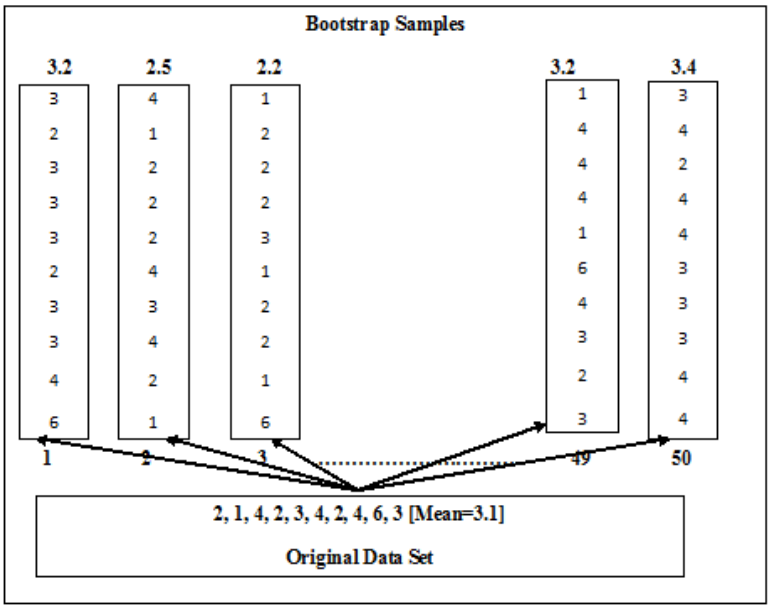


**Figure 2: The Bootstrap Scheme for Estimating a Standard Error**

From the above bootstrap scheme we have the first bootstrap sample as (3,2,3,3,3,2,3,3,4,6) and so on. The formula used in this study to find standard error of the bootstrap mean is given by

$$\hat{Se}_{boot} = \left[\frac{\sum_{b=1}^{B}[T_n(X_b^*) - T_n(.)]^2}{B-1}\right]^{1/2}$$

Where $T_n(.) = \frac{1}{B}\sum_{b=1}^{B} T_n(X_b^*)$ and $T_n(X_b^*)$ represent the mean of the b[th] bootstrap sample and hence $T_n(.)$ is the average of B such average (B=50).

**Table 1: Results from Re-Sampled Data Based on the Time to Pregnancy**

| Bootstrap Estimate | | |
|---|---|---|
| **Mean TTP** | **Standard Error** | **95% Confidence Interval** |
| 3.078 | 0.22 | [2.7-3.5] |

## DISCUSSIONS

We have found that on an average three menstrual cycles is required to conceive by Nepali women in Assam with ±0.22 standard error. Thus fecundability among the said couple is to some extent high as theoretical consideration with high probability of conception is likely to conceive within one, two or three cycles. Time to Pregnancy (TTP) measures in pregnant women is now being healthy hand in study of human fertility from epidemiologic view point. These TTP measures have been extensively used by [Alderet et.al 1995 and Bisanti et.al 1996] in internal comparison and to identify risk factors or chances of infecundity over time. The pregnancy attempt may be differ over time, between populations or between segment and community defined according to given determinant. Obviously a change of partner or divorce usually terminates the pregnancy attempt. Practically such events are rare after the beginning of waiting time to pregnancy.

It should be well accepted that TTP does not provide estimates of fecundity. In the study of [Weingberg et.al 1994 ; Joffe 1997 and Olsen, et.al 1998], it is found that TTP may be a useful measure for identifying determinants of subficundity or infertility if these determinants have no impact on the desire in trying to become pregnant.

## CONCLUDING REMARKS

This paper has discussed the mean time to pregnancy (TTP) among Nepali women in Assam under bootstrap mechanism. There is a strong reason for applying bootstrapping, because usually, data for studies on human procreation are not available in the countries like India as respondents rarely share the sexual knowledge and events. Based on the preliminary finding, this study revealed that under standard fertility conditions Nepali women of Assam conceive in maximum of four menstrual cycles that they try to be pregnant. If any Nepali couples more specifically women do not conceive in three or four menstrual cycles of their trying, then they are suggest to consult with their doctor or further fertility treatment should undergo. Before consulting a doctor couples may try two more menstrual cycles observing the close day of ovulation with high frequency of intercourse, Basal Body Temperature method helps in this connection. On the day of ovulation women's body temperature would slightly increase than the normal one.

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